600 SERIES
PINELLAS COUNTY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURES
WILDLAND/URBAN INTERFACE FIRES

EXECUTIVE LEADERSHIP

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An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

August 2000

ABSTRACT

The Pinellas County Fire Department 600 series Standard Operating Procedures were developed in 1992, and was recently updated in 1998. The problem is that there is no section on Wildland/Urban Interface fires in the 600 series Standard Operating Procedures. The purpose of this Applied Research Project was to research and formulate a Standard Operating Procedure on Wildland/ Urban Interface fires.

Action research methodology was used in this Applied Research Project.

The research questions to be answered are:

1. What are some of the conditions which may be present during a Wildland/Urban Interface fire that mandate the use of special strategies and tactics?
2. What benefit is the use of Class A foam in the Wildland/Urban Interface fire?
3. What is the correct personal protective clothing to wear at a Wildland/Urban Interface fire?
4. What are safety and survival techniques that firefighters can use while fighting fires at a Wildland/Urban Interface?
5. Should there be a preplan for evacuation of residents of subdivisions that are in the Wildland/Urban Interface?

The procedures included a Literature Review of current Fire Service technical journals, reports, and books, as well as other related sources. Technical information was gathered from fire officials throughout the State of Florida.

The results of the research determined that there was a need to develop a Standard Operating Procedure to deal specifically with the Wildland/Urban Interface. The components of the SOP are: tactics and strategies, safety and personal protective equipment, the use of Class A

foam, and evacuation plans for subdivisions bordering the WUI.

Four recommendations were made as a result of this research:

1. Review this Standard Operating Procedure on Wildland/Urban Interface fire by the Pinellas County Operation's Chiefs, with the approval from the Pinellas County fire Chief's Association.
2. That East Lake Fire & Rescue use and purchase the appropriate Class A foam system for brush apparatus.
3. That East Lake Fire & Rescue should include in future budgets the purchase of Personal Protective Clothing for Wildland/Urban Interface fires.
4. That East Lake Fire & Rescue should develop a preplan for subdivisions in the interface regarding the evacuation of each residence within the specific development.

A draft of the Wildland/Urban Interface fire Standard Operating Procedure can be found in Appendix A.

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INTRODUCTION

As urban property owners seeking privacy move deeper into Wildland areas, structure exposures become part of the forest fuel load. As a result, structure fires become part of the risk and are added to the job description for structural firefighters as well as wildland firefighters. In 1998, 20 units from Pinellas County were dispatched throughout the state to assist other agencies in the Wildland/Urban Interface fires. Once again, this year, in a drought situation, in Pinellas County there were more than 100 Wildland fires and some threatened subdivisions at the interface.

According to Robert Winton in *Firehouse* magazine:

> Through a mutual aid response plan, your department may be called upon to assist another city, town, county or state in battling a serious Wildland or W/UI fire. Will your agency be prepared to do this safely, effectively and efficiently with the tools and equipment on hand (Winston, 2000, p. 107).

The first step in answering these questions is to "evaluate your agency's current policies and procedures. Are SOPs lacking, obsolete or uncharacteristic of the actual conditions in your jurisdiction" (Bisbee, 1993, p. 52)?

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BACKGROUND AND SIGNIFICANCE

In 1998, the State of Florida was under attack from one of the most destructive enemies: fire. Florida was enduring a 100-year drought, "most of the state's drought index was measured in the range of 500 to nearly 800" (Winston, 1998, p. 55). From late May through mid July "... at least 2,236 fires ignited nearly half a million acres of dry Florida vegetation" (Winston, 1998, p. 54). Local structural firefighters and wildland firefighters from the Florida Division of Forestry became overwhelmed by the number and size of the fires.

> Structures destroyed or damaged exceeded more than $2.6 million; the number of people sheltered was well over 7000; evacuees totaled more than 80,000; fire suppression costs were expected to top 133,480,000 dollars. At least 450 engines and other brush fire trucks were in operation, with more than 7,000 firefighters from federal, state, local, and volunteer agencies working at the peak periods (Winston, 1998, p. 56).

In 1998 Pinellas County was spared the devastation from the wildland fire that the rest of

the state experienced. Through the state wide mutual aid agreement fire departments in the county sent 20 units to the Wildland fires throughout the state.

Pinellas County is located on the west coast of the State of Florida. "It is the state's most densely populated county, which is essentially built out. The winter tourist season population can be as high as 1.2 million people, with an off-season population of 800,000 people" (Park, 2000, p. 11E.) The residents of Pinellas County are protected by fire and emergency response agencies throughout the County. Together there are 23 fire departments. All of the agencies are functionally consolidated. This is possible with automatic aid and a Standard Operating Procedure that were developed by the Pinellas County Operations Chiefs, a subcommittee of the Pinellas County Fire Chief's Association. "The intent of this manual (SOP) is to provide the various fire departments in the County with a model by which to function in a uniform fashion on an emergency scene" (Pinellas County Operations Chiefs, 1998, p. 1).

There are pockets of Wildland areas throughout the County through its state and county park system, and its highway system. The largest Wildland area in Pinellas County is in the East Lake Fire Control District. It is the Brooker Creek Preserve (BCP).

> With more than 8,500 acres, the preserve is the largest undeveloped piece of land in Pinellas County. The BCP is rectangular in shape and measures approximately 8 miles long and 1-1/2 miles wide, stretching north to Pasco County lines, to the city limits of Oldsmar to the south, nestled between Hillsborough County lines to the East and various housing developments on its borders with more than 20 subdivisions whose backyards touch the preserve (May, 1998, p. 4).

East Lake Fire and Rescue and the Florida Division of Forestry are responsible for fire mitigation on the preserve. ELFR receives approximately $8,000 a year for its fire protection of

the preserve, which is used for tools and equipment for better suppression of fires.

Case Study

June 3, 1999 lightning started a fire on the Brooker Creek Preserve that threatened the subdivision of Coventry Village. There was a voluntary evacuation issued for 12 homes in the Ridgemoor subdivision and a mandatory evacuation of 18 homes in the Coventry Village subdivision. Residents who tried to drive away from the wildfire found it difficult to do so. "Fire trucks and a 5 inch diameter hose blocked their exit. A few residents were able to drive on the sidewalk, while many did not realize they could leave the neighborhood that way." (Gilmer, Quioco, 1999, pg 8.) There was a bottleneck because just one road leads into and out of the neighborhoods. Ron Taylor, East Lake Fire & Rescue Fire Chief, said "the fire department does not have specific evacuation plans for neighborhoods that border the Preserve." (Gilmer, Quioco, 1999, pg 8). The Times learned that there is no evacuation plan here for getting residents out of the neighborhoods when threatened by fire. David Bilodeau, the County's Emergency Management Director, said "a written plan may not be as useful as it sounds. It is not like a fire drill in a building", he said. "You have to look at where the fire is and modify your plans based on that" (Gilmer, 1999, pg. 7). There were some lessons that could be learned from this fire that used Standard Operating Procedure tactics and strategies. There were no homes lost, and no injuries involved in this fire, but a critique of this fire pointed out deficiencies in the SOP's that can be corrected.

This researcher completed a review of the Brooker Creek fire in addition to the Pinellas County 600 series Fire Department Standard Operating Procedures. The result of this investigation revealed that there is no standard operating procedure that deals with Wildland Urban Interface fires. Part of this researcher's responsibility as Training Officer for East Lake Fire

& Rescue is to develop a standard operating procedure for the Pinellas County Operations Chiefs to use. The Standard Operating Procedure was formatted in an Applied Research Project to satisfy the Applied Research Project requirement associated with the Executive Fire Officer Program at the National Fire Academy.

The research related to the Kast and Rosenzweig Systems model of the *Executive Leadership* course. The focus of unit 2 was to analyze the five subsystems of the Kast and Rosenzweig System. The key organizational subsystem used for this Applied Research Project is the Goals and Values Subsystem, "Overall Goals, Unit Goals and Individual Goals" (National Fire Academy, 2000, p. 2-5).

LITERATURE REVIEW

The purpose of this literature review is to establish a foundation for this Applied Research Project. This includes studying the concepts of a Standard Operating Procedure, and its implementation to be used in combating Wildland/Urban Interface fires.

"The Wildland/ Urban Interface is where the Wildland (grass, brush, trees and other vegetation) come in contact with structures and people"(Queen, 1994, p. 67). The United States Forest Service, National Fire Protection Association and the United States Fire Administration have identified three types of interface:

> (1) The Classic Interface: This is where Wildland contact areas of development along a very distinct boundary .(2) The Intermix: This is where homes and other developments are distributed throughout forest and brush lands. (3) The Occluded Interface: This is where pockets of undeveloped Wildland are completely surrounded by developments (Dennis, 1999, p. 64).

The type of interface in which the fire is burning will dictate the type of attack and resources needed. There is no single fire apparatus that could deal with every situation at a Wildland/Urban Interface fire. "Each engine company or group of engine companies should be assigned according to the type of fire in which it will be operating" (Queen, 1993, p. 14). "The engine company is the most versatile firefighting tool you have in your arsenal. It is self-contained: it has firefighters, equipment, water, hose, pump, communication equipment, and even some logistical support capabilities" (Teie, 1997, p.455).

Perimeter Control

Fire suppression in a Wildland/Urban Interface is determined by many factors. A primary measure of fire behavior is the rate at which the flame front advances through the Wildland fuel bed called the rate-of-spread (ROS). "The ROS sets the pace or timetable of events into which we must fit our control actions and safety responses" (Bishop, & McFadden, 1998, p. 40). A key to success in fire suppression during Wildland/Urban Interface fire is staying focused on the fire you are battling. This is a vegetation fire spreading through forest fuels that occasionally encounters a home and perhaps sets it on fire. "Under these conditions, normal structural firefighting strategies will not work. They are too rigid. Fighting fires will have to be flexible and remain mobile, moving from house to house, protecting as many structures as possible" (Teie ,1994, p. 211). There are some specific tactics to consider when fighting fires in the Wildland/Urban Interface. There are three basic methods of attacking an interface fire.

(1) The direct attack is the ideal method to protect lives and property, it is a fast aggressive attack on the fire. (2) The indirect attack method is used when the fire is too hot to approach. Instead, barriers are established to control the fire from a distance. The fire is allowed to burn into natural or man-made barriers, or burning out and backfiring are used.

> (3) A combination attack will protect exposures by controlling the edges of the fire, while at the same time making a fast aggressive attack on the other part of the fire (Queen, 1994, p. 75).

In all three methods of operation "...always start at an anchor point during any suppression action at a Wildland/Urban Interface fire" (Queen, 1994, p. 91). The size of the hose is important to use in the direct attack.

> Always start out using the size of hose that will best protect you and the crew if there is a sudden flare up or your position is overrun. The structure protection line should be no longer than 200 feet in length. This line should be 1-1/2 inch or 1-3/4 inch for maximum effectiveness (Queen, 1994, p. 93).

"Lay out and charge one hose line for the left side and one for the right side of the structure you are protecting, including a short engine safety line. Always leave one hundred gallons of water in your engine's tank for safety purposes for your crew" (Winston, 1998, p. 44).

Structural Triage

According to Teie, "although historically engines have been classified informally as [plug buggies] capable of structural firefighting only, it is perhaps time to adjust our philosophies . These engines are quite capable of attacking wildfires" (Teie, 1994, p. 212). Engine companies must remain mobile and will have to triage the structures, when the number of homes at risk exceeds the number of engines available. "We refer to homes specifically because during the WIF outbuildings such as barns, garages, sheds, etc often become secondary" (Cowardin, 1995, p. 40) Generally, structures of this type are not protected unless they are the only building threatened or are close to a residence. "The goal of structural triage is to do the most good with what you have, and to not waste limited resources or time" (Cowardin, 1995, p. 41).

There are three categories of structural triage: (1) Structures that are basically secure and require little or no protective action. (2) Structures that require protective action, but are savable with adequate resources. (3) Structures that are not savable (Winston, 1998, p. 114). It is the potential saves you must plan for and deal with when trying to determine if a structure can be protected.

"The intensity of the fire will dictate how much defensible space will be necessary" (Teie, 1994, p. 201). "Defensible space should be a minimum of thirty feet cleared area on all sides of the structure" (Cowardin, 1995, p. 41). If the structure has flammable siding and roof covering, it will be difficult to save. "Most of the time when homes are not burning, you need to be at least ten minutes ahead of the advancing fire front. This time allows a company to get set up to defend a home or other structure" (Cowardin, 1995, p. 42).

The decision to defend a structure may rest on its type of roof:

> If you find a roof fire that does not involve more than 1/4 of the roof, you may be able to save the structure. Use both exterior and interior attack lines. Pull the ceiling to gain access to the attic. Be sure all firefighters actively fighting fire in the interior of the structures are in full structural personal protective equipment. If knockdown is not accomplished quickly, the chances of success are doubtful (Teie, 1997, p. 455).

The fire may be some distance from the structure, but a flying brand may have landed on the roof. "Flammable roof material and debris are the first areas to check. As the fire draws closer, the eaves or gable roofs will hold heat" (Teie, 1997, p. 461). Flammable siding will also be a problem. "Although the leading cause of structural ignition in wildfires is airborne embers, the effects of flame impingement and significant or prolonged radiant heat must also be considered" (Terwilliger & Waggoner, 1998, p. 58). "In windy conditions, firebrands can enter virtually any

opening, even under roof tiles and tightly fit siding" (Teie, 1994, p. 218).

As the main fire approaches, reduce the heat from hot spots. Use the hose lines to knock down flare-ups as they occur. "Don't just stand there wasting water by launching it into the air. Wetting down an area is a waste of time and water. Use the limited water you have to actually suppress the fires. Use the water to reduce or limit the buildup of heat" (Teie, 1997, p. 456).

Try to determine how many structures are directly threatened and when they will be threatened. "The [direct threat zone] is that area in which the fire is expected to threaten, not the whole community" (Teie, 1994, p. 209). "As a rule of thumb, you should assign one engine per structure in the [structure threat zone] with one additional engine for every 5 engines assigned to be used to patrol the area" (Teie, 1994, p. 205). For continuous structures, less than 50 feet apart:

> 1 engine per 2 structures, one engine company may be able to protect two structures. Large commercial structures or structure already involved will require the assignment of additional engines companies. For clusters of 20 or more homes less than 50 feet apart, count the number of homes on the perimeter, divide by four and that equals the number of single engines needed plus one additional engine strike team (Backoro & Worto, 1991, p. 451).

If you are protecting a structure, you usually have access to the building. This means you may need to enter it to check for fire. "Be sure that you and your people treat the resident's property as you would want your property to be treated. If you do enter a structure, leave a note as to who you were and what you did" (Teie, 1997, p. 459).

Once the structures are safe, the engine company may be moved to protect another threatened structure. But lingering, unseen ignition sources can easily take houses left behind. "Turbulent winds near the fire front envelop structures in a swirl of hot brands and can deposit

them around, on and even in structures" (Bishop, 1998, p. 58). They can be driven into attics through vents and between roof tiles, or under floors through sub floor vents and openings. There they sit, smoldering sometimes for hours, until the house catches fire. "A mobile unit, that is, an engine or other vehicle with a couple of personnel, can patrol and inspect residences for hours. As time passes, the risk of delayed ignitions eventually diminishes, and a unit can eventually patrol more areas" (Bishop, 1998, p. 59).

An efficient way to fill the patrol function "...is to rotate tired engine crews out of the fire front action and into a surveillance assignment" (Bishop, 1998, p. 61).

Class A Foam

Class A foam is one of the best tools to use during a Wildland/ Urban Interface fire. "The foam dramatically increases water amounts and increases an engine company's capabilities and effectiveness" (Winston, 1998, p. 42).The most important technological aspect is how Class A foam enhances water's capability to control fires. "An active portion of the concentrate in Class A foam is a surfactant. The surfactant, a long-chain molecule, has one end that is attracted to water, while the other is repelled by water and attracted to hydrocarbons" (Koehler, 1993, p. 12). "This results in reduced water surface tension and its ability to cling to vertical surfaces and makes it very useful in protection of structures. The action of the surfactant in foam lets water that would normally run off penetrate and stay with the fuel" (Backoro & Worto, 1991, p. 459).

When applying foam to a structure, timing is critical. "Begin treating about 10 to 15 minutes before the expected front arrives" (Teie, 1997, p. 460). When time permits, several coatings of the structure with Class A foam allows the moisture within the foam to penetrate porous materials "The foam blanket may last a couple of hours in cool, calm conditions, but more likely 15-30 minutes in most situations" (Teie, 1994, p. 214).

"Class A foam operations ahead of a flame front has saved many structures during Wildland / Urban Interface fires" (Winton, 1998, p. 46).

Personal Protective Equipment

Another area in which differences are evident between structural and Wildland firefighting is personal protective equipment (PPE). The correct PPE that is worn at a Wildland/ Urban Interface fire is important. "Proper clothing can help to prevent heat related injuries and allow firefighters to be more efficient and safer while operating" (Winston, 1998, p. 101). The approved type of Wildland PPE consists of a "...Wildland helmet with a Nomex Arab-type shroud, and eye protection [goggles]" (Winston, 1998, p. 102). Structural hoods add an extra, effective degree of protection in addition to the shroud. Division Chief John Hawkins does not advocate always wearing structural hoods on wildfires,

> ...but I do suggest that they be worn when conditions worsen. I also suggest that hood wearers consider turning the hood 90 degrees to put hood fabric over the face if they must seek refuge on the ground or in a shelter. Turning the hood has two values. The fire-resistant fabric better protects the face and the vitally important airway, and it also acts as an air filter, protecting against inhalation of debris or irritants (Hawkins, 1996, p. 46).

The practice that many firefighters use of covering the face with a wet cloth has been shown to actually damage the lungs. "Studies have also shown that you can survive in a dry environment during a fire much longer than a wet one, as a wet environment will cause more lung damage" (Queen, 1994, p. 38).

When fighting Wildland fires "...firefighters should wear 8 inch lace-type boots with heavy lug soles. A fire retardant work uniform with a long sleeve shirt and Nomex of fire-retardant cotton Wildland brush jacket and pants. A good pair of leather gloves should be worn at all times"

(Winston, 1998, p. 102). All firefighters should have their own fire shelters, to be worn at all Wildland /Urban Interface fires . "Many firefighters attach their fire shelter to a military-type web belt or to [fire fashion] designed web gear. Web gear has the advantage of packing the fire shelter, canteen, flare/fusee and radio in one set-up" (Hawkins, 1996, p. 47).

At the Wildfire Planning Meeting- Co hosted by Florida Division of Forestry and Pinellas County EMS/Fire Administration, State Forest Ranger Patrick Dwyer reported that wildland protective clothing can be purchased under the State GSA through Department of Forestry.

"Firefighters operating at a Wildland fire where they will be working in a structure that is burning must wear full structural PPE and self-contained breathing apparatus" (Winston, 1998, p. 101). Personal Alert Safety System devices (PASS) are not just for structural fire operations. "While operating at a Wildland/Urban Interface fire, wear your (PASS) device, and don't forget to activate it. Also, remember to use your fire department's accountability SOPs" (Winston, 1998, p. 114).

Safety

The actions firefighters and officers take to protect themselves are important parts of their ability to operate safely at a Wildland/Urban Interface fire. "This is important because firefighters performing structure protection in the interface generally operate at the head of the fire, between the fire and the structures being protected. This is one of the most effective, yet most hazardous places to fight the fire" (Harris, 1999, p. 35). Every year, firefighters are trapped, injured and killed while fighting Wildland/Urban Interface fires. "It is essential to learn survival techniques in order to save lives and protect property while fighting fires in the interface" (Queen, 1994, p. 37).

Firefighters must constantly be thinking how to avoid becoming entrapped, "... but, if they do, the order of refuge of choice is to get into: (1) a substantial structure, (2) a vehicle, or (3) a

shelter" (Queen, 1994, p. 29).

> In almost all cases, the safest refuge site is inside a substantial structure. The fire may eventually burn the structure, but by that time the major fire run has probably passed, and the firefighters can exit, assess their situation and take the next most appropriate action, which may be as simple as extinguishing the exterior fire around the structure (Hawkins, 1996, p. 46).

A swimming pool can be a refuge site "...in one instance where firefighters took refuge in a swimming pool, they used a 1-quart canteen as a snorkel breathing tube after cutting the bottom out" (Hawkins, 1996, p. 44).

If no structure is available use the cab of the engine as a place of refuge. The company officer should always position fire apparatus with the thought of potentially using the engine as a refuge site. "This means backing in the engine so that the heat hits the rear and not the cab" (Hawkins, 1996, p. 45). The key points to taking refuge in a engine are:

> 1) to ensure company accountability, the ranking officer gets in last 2) all doors and windows must be tightly shut, and no hose line should be brought inside, 3) keep the motor running, the pump engaged, 4) to avoid radiant heat, all personal should stay below the glass level, 5) make sure all members are in the cab with all protective clothing and self-contained breathing apparatus (SCBA) donned, 6) an opened fire shelter or blankets should be used to cover the interior side of windows to help shield against radiant heat (Hawkins, 1996, p. 48).

As a last resort a fire shelter should be the last choice for refuge. " The fire shelter has saved many lives in the past and will save many lives in the future" (Queen, 1994, p. 49).

With the introduction of web gear and all the survival tools that attach to it, such as

canteens to prevent dehydration, a radio for communication when trapped and a fuses to burn out an island for protection along with the fire shelters, survival from entrapment at a Wildland/Urban Interface fire has been greatly enhanced (Queen, 1994, p. 32).

Another important aspect of safety is having an escape route for a rapid exit in the event of possible burn over. "Safety zones are a safe area for your refuge just in case the escape route is not accessible. Remember and / or flag any landmarks where entering the fire area" (Winston, 1998, p. 101).

Evacuation

Where there are homes, there are going to be people. If their homes are being threatened by a approaching fire, the homeowners are concerned, angry, and excited. Human beings tend to act unpredictably when faced with disasters. "It has been observed that civilians behavior takes two distinct tacks during a Wildland/Uurban Interface fire, they either flee the approaching fire or stay and try to save their homes" (Queen, 1994, p. 38). The decision to evacuate an area is a difficult one. "If residents have enough time to deliberate, organize, pack their things and travel to a safe destination without becoming involved with panic on the roadways, it may be appropriate to do so" (Oaks, 2000, p. 27). When it comes to evacuations remember that it will take time to get everyone out and then you'll need a place to put them, "It may be better to place them in a safe area of refuge" (Winston, 1998, p. 43). In 1996, the Belli Ranch fire east of Reno spread rapidly into a subdivision in Reno. "The perimeter homes were affected, but were capable of stopping the perimeter at the point. Homeowners were asked to walk across the street to neighbors' homes until the threat passed. This eliminated unnecessary traffic out of the subdivision" (Terwilliger, Waggoner, 1998, p. 57).

Traffic is always a big concern during evacuation. If you evacuate while responding units

are coming in, the result may be a bottle-neck that allows the fire to get larger and causes people to get trapped. “Some studies have shown that your chances of survival are much greater during a Wildland fire if you remain in your car and cover the windows as best you can with whatever will deflect the radiant heat” (Queen, 1994, p. 41). At the Tunnel fire in Oakland California, during the fire “...people left their cars only to perish a few yards down the road” (Queen, 1994, p. 39). Wildland fires are constantly on the move. Using the protection of vehicles or structures will increase your chance of survival until the fire moves on. The Berkeley Hills Tunnel fire is a good example. “People didn’t die in their homes, they died on the roads in a futile attempt to evacuate” (Oaks, 2000, p.29). Another example was the Santa Barbara’s Paint fire, one of the most destructive fires in California. “The only person killed by fire was fleeing from her home. Her home survived, but she did not” (Oaks, 2000. p. 29).

During the Australian brush fires in 1983, people were given the choice to evacuate or stay and defend their homes. “Most people stayed, and the death toll was limited in light of the amount of fire that was produced during the firestorm” (Queen, 1994, p. 37).

If you expect extreme fire behavior and you have time, initiate a request for evacuation. “Only law enforcement personnel have the authority to order an evacuation. In most areas, firefighters can advise people to leave, not order them” (Queen, 1994, p. 40). If the residents are going to stay, turn them into an asset “... make note of where they are, how many of them there are, and those that want to help should be instructed in what to do” (Winston, 1998, p. 45). Their message should distinguish between interior and exterior fire threats. People should continue to immediately exit a building that has a fire in its interior that puts them at risk, but not automatically exit a building when there is an exterior fire threat (Oaks, 2000, p. 28).

Those that choose to evacuate should be allowed back to their homes after the fire front

passes. During the Raulsen fire in northern California in 1994,

> The homeowners were allowed back into the devastated area immediately after the fire passed through and the threat was over... homeowners had a better understanding of the environment with which firefighter must interact. Complaints about property loss diminished, and many homeowners became part of the [team] that continued to protect the neighborhood from smoldering fire (Terwilliger & Waggoner, 1998, p. 57).

The typical fire department's focus in developing preplans is for man-made structures. "Wildfire preplanning is widely relied on throughout the country" (Bisbee, 1993, p. 49). Subdivision must be preplanned for wildfire. "Preplans should include maps indicating all types of hazards and areas with the potential for high fire intensity" (Terwilliger, Waggoner,1998, p. 61). Preplanning is the key to this process.

> If we know that there is heavy fuel loading in certain area with a heavy population, them we can react accordingly. Just as we would send more resources to a commercial fire than we do a residential fire, so should we send more resource to a heavy-fire loaded area in the interface area (Bisbee, 1993, p. 49).

Large subdivision maps would show the areas of refuge and indicate where homeowners could go to be kept abreast of current events during the fire" (Terwilliger, Waggoner, 1988, p. 61)

The findings and observations of those quoted in the literature review convinced this researcher that the fire service can and must be proactive toward mitigating fires in the Wildland/Urban Interface. This can be accomplished by developing tactics and strategies, safety survival techniques, subdivision evacuation plans, and the use of properly fitted personal protective equipment and of Class A foam.

PROCEDURES

Definitions of Terms

Defensible Space	An area that is typically a width of 30 feet or more, between an improved property and a potential wildfire where the combustibles have been removed or modified with the following intent: (a) To protect life and property from wildfire (b) To reduce the potential for fire on improved property spreading to Wildland fuels (c) To provide a safe working area for fire fighters protecting life and improved property.
Fire Head	That portion of a fire showing the greatest rate of spread: i.e., generally to Leeward or up slope.
Fire Shelter	An item of protective equipment configured as an aluminized tent utilized for protection, by means of reflecting radiant heat, in a fire entrapment situation.
Structure Triage	The sorting and prioritizing of structures requiring protection from wildfire.
Wildfire	An unplanned and unwanted fire requiring suppressive action; an uncontrolled fire, usually spreading through vegetative fuels and often threatening structures.
Wildland/ Urban Interface	The line, area, or zone where structures and other human development meet or intermingle with undeveloped Wildland or vegetative fuels.

Research Methodology

Action methodology was used to research the problem. The goals of the action research were to develop a Standard Operating Procedure, 600-28 Wildland/Urban Interface fire for

Pinellas County Operating Procedures. And assist other fire departments that need help in developing a Wildland/Urban Interface fire Standard Operating Procedure.

Resources available at the National Emergency Training Center's Learning Resource Center at the National Fire Academy. Additional review of literature was conducted in the library at East Lake Fire & Rescue using periodicals, magazines, and trade journals that were sources of background and technical information about Wildland /Urban Interface fires. On-line research was conducted using the Internet to ascertain a preexisting standard procedure that dealt with Wildland/Urban Interface fires. The NFPA 295 *Standard for Wildfire Control*, NFPA 299 *Protection of Life and Property from Wildfire*, and NFPA 1977 *Protective Clothing and Equipment for Wildland Fire Fighting* was evaluated and reviewed. A survey was sent out to 20 Fire Departments throughout the State of Florida. The departments contacted had similar Wildland areas adjacent to their jurisdiction. The data gathered was based on Wildland/Urban Interface fires and on the experience and advice of fighters, fire officer and forestry official. This researcher attended and was part of the Wildfire Planning meeting, Co-hosted by Florida Division of Forestry and Pinellas County EMS/ Fire Administration.

As a result of this Applied Research Project a Standard Operating Procedure was developed. Adoption of this S.O.P. requires review and approval by Pinellas County Operations Chiefs, a subcommittee of the Pinellas County Fire Chief's Association.

The research questions to be answered are:

1. What are some of the conditions which may be present during a Wildland/Urban Interface fire that mandate the use of special Strategies and Tactics?
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5. Should there be a preplan for evacuation of residents of subdivisions that are in the Wildland/Urban Interface?

Limitations

The study was not a random survey. The survey was limited to departments that had similar Wildland areas adjacent to their jurisdiction. It was assumed that the fire officials that responded to the survey where knowledgeable with there department SOPs, protective equipment, and tools used for Wildland firefighting. Further, it was assumed that the officials understood the questions in the survey. However either of these assumptions could be confirmed.

The use of Class A foam is limited due to budgetary restraints and lack of the appropriate equipment in the proper application of the foam. Like wise, the purchasing of the Wildland protective clothing is also limited due to budgetary restraints.

RESULTS

Answers to research questions:

Research question 1: What are some of the conditions which may be present during a Wildland/Urban Interface fire that mandate the use of special Strategies and Tactics?

The Wildland Urban Interface fires are dramatic and fast moving and takes a different type of tactics and strategies to bring this type of situation under control. The Wildland Interface can impact a development and can overwhelm the local jurisdiction's response.

The main focus is on the control of the perimeter of the head fire. Focusing on tactics and strategies to slow down or reduce the rate of spread of the head fire will dictate the pace and the size of the fire that is in the Wildland Urban Interface. The tactic that is the most successful is the direct attack, which is an aggressive attack on the fire. Using the engine company with the minimum size hose of 1-1/2" to 1-3/4" allows the engine company to be most effective with the direct attack. This direct attack is a fast, aggressive attack on the fire with hopes it will catch the small fire before it is a large fire. The indirect attack is not on the perimeter fire but on other flanks or areas that the fire is too hot or structures are already destroyed, and the fire is allowed to burn out to natural or man-made fire lines. Depending on the size and scope of the Wildland Interface fire, there is a potential that there will be several different tactics employed using the combination attack with protecting exposures with a fast aggressive attack by other companies on the head fire to control the rate of speed of the perimeter of the fire. As with all engine company tactics, they should all start at an anchor point for safe escape.

When setting up the strategies for the Wildland Interface, the use of structural triage needs to be employed. One of the key components of structural triage is if the structure has a defensible space. In addition to the defensible space, the type of fuel and fire behavior will dictate the type of strategies to be employed. In addition, if a structure has more than a quarter of it's roof in fire involvement, that structure is not savable and should be written off to allow engines to move on to other savable structures.

The Wildland fire is a large moving fire that could affect part or whole community. The focus of the strategy should be of the direct threat zone where engine companies will be the most useful in that in the structured threat zone. These engines need to remain mobile and not tie into hydrants and get locked into a stationary position. In the direct threat zone, there should be one

engine assigned to every structure that is threatened. With continuous structures, less than 50 feet apart, a good rule of thumb is to count the number of homes on the perimeter, divide by 4 and that equals the number of single engines needed, with additional engine's strike team in reserve.

As the fire progresses and moves out of the area, strategy of taking engines that were on the fire front, that are tired, or have been exposed to severe fire conditions, can be moved to patrol homes that were in the delayed ignition zone, and to assist homeowners with property inspection, or just to patrol that community that was affected by fire.

Research question 2: What benefit is the use of Class Foam in the Wildland/Urban Interface Fire?

The use of Class A foam is very beneficial to the engine company and other units in the suppression of fire within the Wildland /Urban Interface. The chemical used in Class A foam is Surfactant which is a long chained molecule, it has one end that is attracted to water, while the other is repelled by water and attracted to hydrocarbons. This results in reduced water surface tension which gives it an ability to cling to vertical surfaces, making it more productive for structural protection. An engine company given 15 minutes to apply Class A foam to a structure prior to the fire front hitting affords the structure better defense against the flame impingement.

The selection of a foam system for use on the two brush units of East Lake Fire & Rescue was a Hale Foam units. The Hale Foam Master deliver accurate proportioning with lows of 10 GPM to 250 GPM with foam percentages ranging from .1% to 1.0% with a 12 gallon foam tank. The complete proportioning unit and estimated 8 hours to install the system would be approximately $5,500. East Lake Fire & Rescue has two foam systems to install.

Research question 3: What is the correct personal protective clothing to wear at a

Wildland/Urban Interface fire?

Firefighters operating in the Wildland /Urban Interface should be properly dressed in the appropriate protective clothing for the fire situation that they are dealing with. The use of lightweight helmet and goggles, wildland jacket and pants affords the level of protection that firefighters need to be effective while operating for long periods of time in the Wildland/Urban Interface. The use of web belt allows firefighters to carry canteens, to reduce dehydration, a radio for communication, and fire shelter in cases of being overrun by fire.

Wildland protective clothing can be purchased under State GSA through Department of Forestry, that meets or exceeds NFPA 1977 *Standard on Protective Clothing and Equipment for Wildland Fire Fighting*. The cost for a completed set of protective clothing that was selected by East Lake Fire & Rescue was approximately $300. East Lake has 35 personnel to outfit.

It is important that firefighters who are in the Wildland/Urban Interface, that are actively suppressing fires inside of a structure, be properly fitted with their structural protective clothing, with Self Contained Breathing Apparatus, PASS device and that the departments Standard Operating Procedures on personnel accountability be adhered to.

Research question 4: What are safety and survival techniques that firefighters can use while fighting fires at a Wildland/Urban Interface Fire?

Safety at a Wildland/Urban Interface fire is essential to learn survival techniques because many firefighters are working in areas in and around the fire front, which is one of most hazardous areas to operate in. The survival techniques to save the firefighters and their crew needs to be understood that the fire front is a wind driven fire and their safety and survival techniques only need to last for a short period of time. If in the case of becoming overrun by a fire front, the first area of refuge should be inside a substantial structure. Members should remain in the structure

until the fire front passes, and they should have with them their full structural protective clothing with SCBA with them. The second area of refuge should be their fire apparatus. The apparatus should have the tailboard of the engine towards the fire front, and if possible, the crew should remain in the cab with their protective gear on and their SCBA.

If a substantial structure or their vehicle is not available, they should use, as a last resort, their fire shelters.

Research question 5: Should there be a preplan for evacuation of residents of subdivisions that are in the Wildland/Urban Interface?

Where the threat or possibility of a fire front impacting a community, as in the classic interface fire, you should anticipate a potential conflict with the people of that community. There will be people that will be willing to evacuate on their own, and then there will be people who will want to stay and save their house. When it comes to evacuation, engine company personnel can only advise residents to evacuate their homes. It is up to the local law enforcement to order evacuations.

It is not always necessary to evacuate the entire area, you need to evacuate the direct threat zone or the perimeter which might mean moving people from one side of the street to the other.

The main focus of an engine company operating at the Wildland Interface is the mistake of laying in large diameter hoses from hydrants to their engines which will sometimes block the roads for citizens to evacuate themselves. Time permitting, engine companies can assign citizens to help with their structural protection prior to evacuation and also assign them to an evacuation site for notification of when it is permissible to reenter the area to check the status of their structures.

The final product of action research included a draft of Wildland/Urban Interface fire Standard Operating Procedure can be found in Appendix A.

DISCUSSION

This Applied Research Project was formatted according to the Kast and Rosenzweig Systems Model from the *Executive Leadership* Course of the National Fire Academy, using the "Goals and Values" subsystem that was discussed in the first week of class.

Overall Goals:

After reviewing numerous references at the Learning Resource Center at the National Fire Academy, and conducting a survey of 20 Fire Departments in the State of Florida, it was found that at present, there are no Standard Operating Procedures for a Wildland/Urban Interface fire. This Applied Research Project was written to develop a SOP for Wildland/Urban Interface fires. This will add to the body of knowledge now contained within the National Fire Academies resources for use by the entire Fire Service. Locally, it will be beneficial to the Pinellas County Six Hundred Series Standard Operating Procedure.

Unit Goals:

Large interface fires are probably a local fire departments least occurring incidence, but greatest exposure to property damage and loss of life, as in the Florida wildland fires of 1998. The tactics and strategies used in fighting these fires are different than fighting structural fires.

> "On simple fires in your home jurisdiction, matching the tool to the task is relatively simple. Usually, the proper equipment is dispatched, and the training and experience of the firefighters match the task at hand. The situation becomes much more complex when you are required to take an engine company out of its normal element and ask it to take on a task that is out of the ordinary" (Teie, 1997, p. 461).

Using structural triage, sometimes decisions must be made on which structures are savable

and which ones are expendable. It is difficult for firefighters to let structures burn. This is against their action oriented nature, training and experience. But in Wildland/Urban Interface tactics, the fire spreads quickly, so the goal of protection is to stay ahead of the fire. The rate of spread on the perimeter sets the time line of the interface fire. "The time remaining before a fire reaches valuable homes dictates whether we might make an offensive attack on the fire or whether we must take up a position to defend the home" (Bishop, McFadden, 1998, p. 40).

Another valuable tactic for use in Wildland/Urban Interface fires is Class a foam. "Class A foam operations ahead of a flame front have saved many structures during SWI fire fights" (Winston, 1998, p. 42). According to the results of the survey, East Lake Fire and Rescue currently does not have the equipment to use Class A foam, but it is now being considered for purchase in the future.

The results of the survey also state that no department has a section on safety and survival in their SOP.

> "Firefighter safety is threatened when firefighters are placed in a position of operating beyond their training, experience, and equipment capabilities. Operations in the Wildland/Urban Interface are not always well organized and safe due to inconsistent qualifications; performance standards; and experience among local, state, and federal agencies" (Dittmar, May 98 p. 66).

Safety in the SOP should be the number one concern. "Safety is the first decision we should make once we receive an assignment in the interface and the first decision we affirm every time we update our action plan during an evolving fire fight" (Harris, Crandell, 1999, p.34). Use of the proper Personal Protective Equipment is another important safety factor. It is every firefighters' responsibility to insure that personnel are in the proper PPE for the Wildland

Interface.

The decision to evacuate an area, or not, is critical in the safety or people and property in the Wildland/Urban Interface. It is the opinion of fire officials that it requires a minimum of three to four hours to conduct an evacuation in an orderly and safe manner. Because of the rate of spread of a typical Wildfire, this is not always possible. This makes evacuation a poor choice. A better alternative is to create a "safe to stay" environment.

> If homeowners were allowed to stay with their homes under the right conditions, they could save their own investments and memories and assist us in doing our job. We need to create that 'safe to stay' environment *prior to the fire.* As fire ground managers, we need to understand the situation that will allow us to use the homeowner in the development of strategy and implementation of tactics (Terwillinger, Waggoner, 1998, p. 57). In conclusion: to operate safely, effectively and efficiently in a structural wildland fire situation, good judgement, planning, training, the proper equipment and common sense all combine for successful operations. Always remember that safety is the prime concern. No structure or piece of wildland is worth a serious injury or loss of life (Winston, 1998, p. 46).

Individual Goals:

As training officer for East Lake Fire & Rescue, the creation of this SOP will assist me in my job to prepare a class on Wildland/Urban Interface fires in order to share this knowledge and research with the North County Mutual Aid Training Program. This includes six separate fire departments with approximately 250 firefighters.

This SOP will also assist with the planning of the Wildland/Urban Interface at the Brooker Creek Preserve, which is in my jurisdiction.

RECOMMENDATIONS

As a result of the research for this Applied Research Project the recommendations for implementation are:

Recommendation 1: Review this standard operating procedure on Wildland/Urban Interface fire by the Pinellas County Operation's Chief, with the approval from the Pinellas County Fire Chief's Association.

Recommendation 2: That East Lake Fire & Rescue use and purchase the appropriate Class A foam system for brush apparatus.

Recommendation 3: That East Lake Fire & Rescue should include in future budgets the purchase of Personal Protective Clothing for Wildland/Urban Interface fires.

Recommendation 4: That East Lake Fire & Rescue should develop a preplan for subdivisions in the interface regarding the evacuation of each residence within the specific development.

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APPENDIX A

600-28

Subject: Wildland/Urban Interface fire Mitigation

Definition: The Wildland/Urban Interface is where the wildland (grass, brush, trees, and other vegetation) come in contact with structures and people.

Priorities: Wildland/Urban Interface fire priorities are:
1. Protection of life
    A. Civilian
    B. Firefighter
2. Protection of Property
3. Vegetation, fire containment

Fire Behavior

Fire behavior can be defined as the manner in which fuels ignite, flames spread and destruction occurs in the interface. The safety of the firefighters and the civilian population is determined on how well we can predict and control fire behavior. Our ability to read an interface fire will help us deploy forces against a fire or protect exposures and save lives that are threatened.

The interface environment:
A fire in the interface is influenced by three factors:
1. Fuel
2. Weather
3. Topography

Fuels

The effects that fuel has on a fire are determined by seven factors:
1. Moisture content
2. Fuel Loading
3. Compactness
4. Vertical arrangement
5. Size and shape
6. Continuity
7. Chemistry

Moisture Content

Moisture content, in firefighting terms, is the amount of water in the fuel (measured in percentage). When fuel moisture is high, fires burn relatively slowly, with little heat development. When fuel moisture is low, fires burn rapidly, with the higher heat production as the moisture

content goes down.

Fuel moisture is measured in the wildland by the amount of moisture in live fuels and dead fuels. While the fuel is in its curing stage it is relatively easy to determine the moisture content in some fuels by their color. Tn grasses, the color changes from green to brown as they are cured and the moisture content leaves the fuels . Leaves turn brown, and branches become brittle in the larger fuels.

Fuel moisture affects fire spread by its ability to slow down fires in the interface. A large amount of heat is required to drive out the moisture before it will burn. The addition of structures, cars, and flammable liquids that would be found in the interface fire will increase the fire spread by preheating fuels and driving out the moisture content ahead of the fire. This is why an interface fire can be more dangerous than a wildland fire.

Fuel Loading

Fuel loading refers to the amount of fuel available to burn in a given area. When determining the tactics and strategy to use when fighting a structure fire, the incident commander calculates how much fuel is in the structure, what type of fuel is burning and the percentage of involvement. He can then determine the amount of resources he will need to attack the fire. Not unlike the structure firefighter, the wildland/urban interface firefighter must determine how and what type of fuel is burning and will burn as the fire progresses.

Unlike the structure fires, in most cases, the wildland/urban interface fire is dynamic and continues to move until it runs out of fuel, gets put out or burns out on its own. Fuel loading in the wildland/urban interface will be determined by tons per acre, structures, vehicles and other man-made products. To determine resources needed at a wildland/urban interface, we must calculate the amount of fuels that will be consumed. Structures that are added to the wildland fuels must be considered separately when calculating fire spread in the wildland/urban interface. Because these are man-made fuels, it will be difficult to predict what kind of heat that will be generated by these fuels.

The tactics to address fuel loading may include making defensible spaces around structures prior to the fire's arrival. Of course, this takes time and considerable resources. Fuel loading may influence the decision of whether to put a fire line in, evacuate an area or let the fire burn. Fuel loading is a very important factor during a wildland/urban interface fire.

Tactics in the interface

Deployment

1. Back engine in for quick getaway.
2. Have an escape route.
3. Use building for protection.
4. Use natural barriers.
5. Work as a team.
6. Size up the situation before committing.
7. Stay mobile.

Water

1. How much water is needed?
2. Is it going to be effective?
3. Are others using the same system?
4. Use water to extinguish fire only. No pre-wetting!
5. Consider letting things burn that are not vital.
6. Use tank water.
7. Don't lay lots of hose just because there is lots of fire! People, resources, apparatus and water supplies need to stay mobile and move with the fire.

Prepare Structures

1. Create or support defendable space if time permits.
2. Make structures more defendable inside and out.

Attack Fire

1. Only what is burning. No pre-wetting!
2. Under shingles.
3. Under eves.
4. In ground vents or attic vents.
5. In adjacent vegetation.

Common Errors at Interface Fires

1. Laying hose too far ahead of fire.
2. Defending undefendable structures.
3. Tradition!- trying to fight the interface fire like a structure fire or using wildland tactics to fight structure fires.
4. Unnecessary apparatus.
5. Exposing resources too quickly.
6. Deploying resources too late.

7. Laying unnecessary lines.
8. Not staying mobile.
9. Assigning jobs according to rank instead of qualifications.
10. No communications with team members.
11. Saving one house while the rest of the block burns down.
12. Team members wearing structure protective clothing instead of outside firefighting protective clothing.
13. Fire crews sitting around waiting for fire to arrive instead of making structures defendable and creating defendable spaces.

Strategy

MAKE A STAND

The "make a stand" strategy may be the best method of attacking the fire during the initial stages of a wildland/urban interface fire.

Making a stand is very dangerous on large fires. A "perimeter of control" must be established, and communications must be common between the firefighting forces.

Choose roads or natural barriers to make a stand. Stay mobile, and be prepared to move with the fire. Watch out for spot fires or slop overs. Have secondary control lines available with enough resources to control the fire if the "make a stand" strategy does not work.

LET THE FIRE BURN

Sometimes, no matter what you do, it will not be enough. If you recognize the conditions that will make the fire too difficult to fight, the best action to take may be no action at all.

As difficult as it is for firefighters to let fires burn, it may be better to do so until there is a change in the conditions that are causing the fire to burn with such intensity that an attempt to control the fire may not be safe.

You need to make an effort to fight the fire on your own terms and conditions. Attempting to fight an uncontrollable fire may drain your resources and wear out the firefighters so much that they will be ineffective when conditions are better.

Be prepared to write off structures and wildland during extreme fire conditions.

COMBINATION ATTACK

Wildland/urban interface fires are dynamic. On a large fire, it may be possible to combine several tactics at the same time. As the fire grows and becomes large, certain parts of the fire may be more "defendable" than other parts of the fire.

It may be impossible to commit any resources to the head of the fire, while at the same time one flank can have resources safety committed to it.

The combination attack will take coordination and communication with everyone involved.

Structure Triage

As with any major disaster or conflagration, there will be a time when we will have to make the difficult choice of what structures to write off and which ones we should attempt to save. The following considerations should be kept in mind when an interface fire approaches the area you are trying to defend:

Rescue:	As always, if there are people in a structure, the focus should be on that structure or structures first.
Involvement:	If the structure is involved enough that it cannot be put out with a tank of water, write it off.
Exposures:	Decide which exposure is defendable and go for that one. By the time you try to defend an undefendable structure, you may lose the entire block.
Roof Coverings:	If one structure has a wood shingle roof, try to save the one that doesn't.
Defensible Space:	The structure that have a clearance around them can be defended with less effort. If there is no separation of fuels, write it off.
Water Supply:	You need a mobile water supply. If you cannot defend the structure with the water that you carry on your apparatus, you will probably lose the structure.
Personnel:	If you have the time and personnel, you can create a defensible space. Don't try to defend several structures at one time with an engine crew.
Escape Routes:	Do not try to defend structures in an area that will trap your firefighters. Always have an escape route before committing the crews.
Fuel:	Structures that are in heavy timber are difficult to defend. If you have a choice, try to save those structures that have lighter fuels around them.
Wind:	If the wind is over 30 MPH and it is driving the flames directly into the structure, the structure will be difficult to defend.
	When attempting structure triage, safety of the crew always comes first. The structures that you are attempting to save may also be your only escape. You may also have to write off entire blocks that are in the area that are not defensible or safe.

Structure Protection

There are certain things you can do to save a structure before the fire in the interface reaches it, provided there is enough time.

1. Put car in the garage.
2. Remove outside furniture. Put it in the house or away from the house.
3. Remove light curtains from windows and close heavy curtains. Shut venetian blinds and shutters.
4. Close up all openings such as doors, windows, garage doors and vents.
5. Check water systems and garden hoses. Make sure they area on, with nozzles on them.
6. Put house ladders up to the house.
7. Cover windows with aluminum foil.
8. Fill buckets with water.

9. Shut off gas.
10. Evacuate, if it's safe to do so.
11. Clear vegetation from around structure for at least 30feet.
12. Cut limb up trees to six feet. Scatter fuels.
13. Clean roof and gutter of flammable materials.

When the Fire Hits

1. Pull a maximum of 200 feet of hose for structure protection.
2. Do not tie in to a hydrant, except to quickly fill your tank.
3. Do not attack the wildland fire approaching the structure. Extinguish fire on the structure, as necessary.
4. Save water in the tank for your crew's safety.
5. Keep engine running.
6. Keep crew together.
7. Use structure to protect yourself from radiant heat.
8. Do not wet down roofs and adjoining areas.
9. Do not use any line smaller than 1 1/2".
10. Keep apparatus mobile.
11. Move from structure to structure with fire.
12. Keep 100 gallons of water in the tank for firefighter protection
13. Back engine in for a quick getaway.
14. Park in areas with the least amount of combustibles.
15. Wear fire shelters.
16. Make safety zones and escape routes available.
17. Have vehicle protection lines on engine.
18. If fire is too hot, retreat into the structure until fire passes, then extinguish fire on the house.
19. If you are overrun, get into the engine and cover the windows. Take a breathing apparatus with you.
20. Maintain communication with your crew.
21. Keep outside speakers on.
22. Keep windows closed.
23. Conserve water.
24. Wear full protective wildland gear.
25. Realize that you may have to write off one structure to save a lot of structures.

Rescue in the Interface

Rescue during an interface fire could be accomplished in the following manner:
1. Assist those who are evacuating on their own.
2. Evacuate those who are closest to the fire.
3. Evacuate area ahead of the fire.
4. Try to move those trapped to an area were they can be protected from the radiant heat.
5. Move those people that are in an open area to a location were there is the least amount

of combustibles. You may have to burn out an area into which to move yourself and those whom you are trying to protect.

6. As with a high rise fire, the best way to rescue large numbers of people from a wildland/urban interface fire is with a fast aggressive, attack on the fire.

It is important to remember that crew safety comes first. If you are prepared with the proper survival techniques, an evacuation plan and the knowledge of fire behavior, rescue in the interface can be accomplished even in the most severe situations.

Evacuation

We need to remember that we must have time and space if we are to consider evacuations. It take time to get people to safety, and it takes space to move them out of danger from the fire. If we don't have enough time and space, we may consider leaving them in their homes until the fire storm passes.

During future major wildland interface fires and other disasters, people will be on their own for hours, possibly even days without professional help. The public needs to be aware of this. Trying to rescue hundreds of people while a major wildland fire is burning is not practical and is destructive, in some cases.

We have a choice of removing the fire from the victims or removing the victims from the fire, or a combination of both. Rescue will always be a priority, but how we accomplish it is up to the incident commander and firefighters who are assigned this task. The judgment should be based on predicted fire behavior, and the less-predictable human behavior.

Escape and Entrapment Procedures

In some instances, there may be no chance to avoid fire. When entrapment is probable, and you are without your protective clothing or fire shelter, injuries or death may be avoided by following these procedures:

1. Do not panic. If fear becomes overwhelming, judgment is seriously impaired and survival becomes a matter of chance.
2. Do not run blindly or needlessly. Unless the path of escape is clearly indicated, do not run. Move away from the flanks of the fire, traveling downhill where possible. Conserve your strength.
3. Enter the burned area. Do not delay. If escape means passing through the flame front into the burned area, do so when flames are less then three feet deep and you can see clearly through them. Cover exposed skin, take several breaths, and move through the flame front quickly.
4. Burnout. If unable to enter the burned area, ignite grass and other fine fuels between you and the fire edge. Step into this burned area and cover as much of your exposed skin as possible. This action will not be effective in heavy fuels that burn for a long time.
5. Regulate breathing. To avoid inhaling dense smoke, take shallow, slow breaths close to the ground.
6. Protect against radiation. Shield yourself from heat rays by seeking a shallow trench, crevice, large rock, lakes, streams, large ponds, vehicles, or buildings. Don't seek

refuge in elevated water tanks. Wells and caves generally should be avoided, because oxygen may be quickly used up in these restricted places. Cover exposed skin with clothing or dirt.

7. Lie prone. In an emergency, lie flat with head down on an area that will not burn. A person's chance of survival is greater in this position than if overtaken by fire when standing upright or kneeling.

Survival in a Vehicle

If trapped in your vehicle by fire, the following steps will enhance survival:

1. Do not drive through dense smoke.
2. Park away from heaviest vegetation.
3. Turn headlights on.
4. Do not leave the vehicle.
5. Roll up windows and close vents.
6. Get on the floor and cover the windows with turnouts, fire shelter, coat or blanket.
7. Stay in the vehicle until the main fire passes.

While it is frightening to be trapped in a vehicle by fire, it is almost certain doom to attempt to escape by running from fire.

A few facts to prevent panic

1. Engine may stall and not restart.
2. Convection currents may rock vehicle.
3. Smoke and sparks may enter the vehicle.
4. Temperature will increase inside the vehicle.
5. Metal gas tanks and containers rarely explode.

APPENDIX B

EVACUATION PLAN IS MORE THAN YOU MAY THINK

Everyone living in a wooded area should have an evacuation plan. It should be discussed periodically, and parts of it should even be rehearsed.

An evacuation plan is more than a description of how to get out of the house. A complete plan includes:

* An escape route.
* A family meeting place.
* Instructions for children.
* Steps to make your house as fireproof as possible.
* Plans for a fast getaway.
* Provisions for pets.

Generally, a family forced by wildfire to evacuate will do so together, so the escape route will be the same for all. It is important to establish a meeting place in case all family members are not home when the evacuation takes place.

Children who are home alone should have firm instruction to leave the home at the first threat of danger. They should report to the prearranged meeting place and stay there until they hear from you. Should they encounter a threatening situation upon arriving home, their instructions should be to go directly to the meeting place.

Depending on how much time you have before an approaching wildfire could likely reach your vicinity, here are some things you can do to help fireproof your home, ensure a fast getaways, and take care of pets:

OUTSIDE THE HOUSE

* Cut tree limbs up to 6 feet.
* Inspect your rain gutters and roof for any accumulation of pine needles of leaves.
* Place combustible items (outdoor furniture, etc.) In the garage, house or barn.
* Seal up attic and ground vents and windows (if storm shutters are not present) with precut plywood to keep out sparks.
* Connect garden hoses to outside taps; equip them spray-gen nozzles. Have enough hose to reach any area of the house and nearby out-buildings.
* Turn off fuel supplies by closing the service valve at the tank or meter. Extinguish all pilot lights.
* Place sprinklers on the roof and near all above-ground fuel tanks or meter. DO NOT turn on the water until the fire is near in order to conserve water.
* If you have a portable gasoline-powered pump to take water from a swimming pool, tank or pond, make sure it is operational and in place.

INSIDE THE HOUSE

* Close all windows and doors to prevent sparks from blowing inside and to prevent drafts.
* Open the damper on fireplaces to stabilize inside-outside pressure, but close fireplace screens to keep sparks from igniting the interior of the house.
* Turn on a light in each room to make the house more visible in heavy smoke.
* Remove lightweight curtains to prevent them from being ignited by radiated heat.
* Close all venetian blinds and heavy drapes to keep out heat and to provide safety in case heat or wind breaks windows.
* Cover windows with aluminum foil.
* Move flammable furniture away from windows and sliding doors to reduce the possibility of ignition.
* Fill buckets with water.
* Place valuable papers and memorabilia inside the car for quick departure.
* Confine pets to one room so they can be easily located.
* Back the car into the garage and roll up the windows.
* If there is an automatic garage door opener, disconnect it so you can still get the car out if a power failure occurs.
* Close all garage doors and windows.
* Keep your radio tuned to a local station for fire reports and evacuation information.

In the event of a fire or when emergency equipment is needed, valuable time can be lost if rescue personnel have to take time searching your home. When firefighters arrive, it is wise to leave the task of protecting your home to the professionals. A quick briefing about such things as the location of water supplies, buried utility lines and septic tanks, and any hazardous materials you have stored will be welcomed. But after the briefing, the best way to assist the firefighters is to retreat to a safe place while they concentrate on protecting your home without having to protect you too.

APPENDIX C

A survey was conducted to see if other fire department have a Standard Operating Procedure for Wildland/Urban Interface Fire. In addition the type of protective clothing and special equipment used.

1. Does your fire department have a written Standard Operating Procedure for Wildland/Urban Interface Fires?

Yes No

2. If yes, does the Standard Operating Procedure have a section on safety for firefighters operating at a Wildland/Urban Interface Fire?

Yes No

3. Does your fire department use Class A foam on Wildland/Urban Interface Fires?

Yes No

4. Does your fire department provide Wildland Protective Clothing?

Yes No

5. Does your fire department have a evaluation plan for subdivision or homes in the Interface?

Yes No

APPENDIX D

A survey was conducted to see if other fire department have a Standard Operating Procedure for Wildland/Urban Interface Fire. In addition the type of protective clothing and special equipment used.

1. Does your fire department have a written Standard Operating Procedure for Wildland/Urban Interface Fires?

Yes 0 No 20

2. If yes, does the Standard Operating Procedure have a section on safety for firefighters operating at a Wildland/Urban Interface Fire?

Yes 0 No 20

3. Does your fire department use Class A foam on Wildland/Urban Interface Fires?

Yes 14 No 6

4. Does your fire department provide Wildland Protective Clothing?

Yes 12 No 8

5. Does your fire department have a evaluation plan for subdivision or homes in the Interface?

Yes 0 No 20